



GENERAL SPECIFICATIONS FOR CONCRETE AND REINFORCED CONCRETE

UGS

Revision

DATE: 8/15/07

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APPROVAL: Dave Redding

MATERIALS

1. PORTLAND CEMENT

Cement used shall be Portland Cement in accordance with ASTM C150, as last adopted or revised. Type II Portland Cement shall be used unless otherwise specified by the Department.

2. CONCRETE AGGREGATES

2.1 Aggregates shall conform to ASTM C33, as last adopted or revised, with respect to general characteristics, soundness and freedom from deleterious material.

2.2 Fine aggregates shall be well graded and washed natural sand without shale, alkali, mica, coated grains or soft or flaky particles. In addition to other grading requirements, the fine aggregate shall contain at least three percent but not more than six percent material passing a No. 100 sieve. At least 15 percent but not more than 25 percent passing a No. 50 sieve, and shall have a fineness modulus not more than 3.00 nor less than 2.50.

2.3 Coarse aggregates shall be clean, sound gravel, well graded in size, from the minimum to be retained on a No.4 screen, to the maximum respective size specified for each design.

3. WATER

Water used in mixing concrete shall be clean, clear, potable and free of materials likely to be harmful to the concrete.

4. METAL REINFORCEMENT

4.1 Reinforcing bars shall be a deformed type and shall conform to the following ASTM designations as last adopted or revised: ASTM A305, A15, or A16. Either new billet stock of intermediate grade or rail steel stock may be used provided that stock to be bent shall be suitable for cold bending.

4.2 Expanded steel made of stock with less than 1/16 inch thickness shall be painted or galvanized after being expanded. When made from heavier stock, no finish is required. The minimum mesh dimension shall be not less than 1 1/2 inches.

4.3 Welded wire fabric may be substituted for expanded steel. It shall have at least 50% more than the specified minimum weight of the expanded steel and be fabricated of No. 12 AWG or heavier wire with a minimum mesh dimension not less than 2 inches.

5. ADMIXTURES

Only specified or specially authorized admixtures shall be used.

6. READY MIXED CONCRETE

Ready mixed concrete shall conform to ASTM designation C 94.44, as last adopted or revised. There shall be furnished with each load, a legible certificate describing the mix, identifying the materials used and stating the quantity of additional water, if any, which may be added to the mix to bring it to the specified water-cement ratio.

7. MEASUREMENTS

7.1 Measurements are to be determined at a temperature of 70° F. When the ambient differs, the values shall be corrected to 70° F.

7.2 Water content is the gross amount of water in the mix, including surface water contained on the aggregate.

7.3 Refer to paragraph 11 for slump measurements.

7.4 Deviations in specifications require variations in the design and are limited to those detailed in paragraph 10.



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CONCRETE DESIGNS

8. DESIGNS FOR MECHANICAL VIBRATION

DESIGNATION	MIX #4000	MIX #4002	MIX #2000
Water Content:			
Ratio of water to cement by weight	.50±.05	.50±.05	.70±.0
Gallons per sack	6.0	6.0	8.5
Admixture:			
Suconem red label pints/sack	1	1	1
Minimum Fine Aggregate Content:			
Sand in % of total by absolute volume	37%	46%	60%
Maximum size coarse aggregat	1 ½"	¾"	¾"
Minimum Cement Content:			
Pounds per cubic yard	520	565	375
Sacks per cubic yard	5.5	6.0	4.0
Allowable Slump:			
Minimum slump	2"	2"	3"
Maximum slump	3"	3"	4"
Strength Requirements:			
Minimum p.s.i. at 28 days	3,000	3,000	1,500
Compaction:			
	Vibrator	Vibrator	Vibrator

9. DESIGNS FOR HAND COMPACTION

DESIGNATION	MIX #4001	MIX #4003	MIX #2001
Water Content:			
Ratio of water to cement by weight	.50±.05	.50±.05	.70+.05
Gallons per sack	6.0	6.0	8.5
Admixture:			
Suconem red label pints/sack	1	1	1
Minimum Fine Aggregate Content:			
Sand in % of total by absolute volume	37%	46%	60%
Maximum size coarse aggregate	1 ½"	¾"	¾"
Minimum Cement Content:			
Pounds per cubic yard	580	630	405
Sacks per cubic yard	6.3	6.7	4.3
Allowable Slump:			
Minimum slump.	3"	3"	4"
Maximum slump	5"	5"	6"
Strength Requirements:			
Minimum p.s.i. at 28 days	3,000	3,000	1,500
Compaction:			
	Hand	Hand	Hand

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10. VARIATIONS REQUIRED FOR DEVIATIONS

10.1 Angular Coarse Aggregate:

- A. Angular coarse aggregate may be used in a mixture designed for vibrator compaction provided:
 - Fine aggregate percentage of total aggregate is increased five percent, by absolute volume.
 - Cement content is increased to quantities shown for comparable design for hand compaction and the water-cement ratio is kept within the specified value.

- B. Angular coarse aggregate may be used in mixtures designed for hand compaction without increase in cement content provided that the fine aggregates percentage of total aggregate is increased five percent, by absolute volume.

10.2 Grading Of Aggregates

- A. No variation allowed in grading of fine aggregates without special authorization.
- B. The "well graded" characteristics of both fine and coarse aggregates shall be such as to yield a smooth, plastic, cohesive mass of wet concrete when the water content and slump are within specified limits. Cement content shall be increased as necessary to obtain this result whenever the aggregate grading used does not produce such results.

10.3 Slump

Slump may be increased provided that the cement content is increased at the rate of 1/3 sack of cement per cubic yard of concrete for each inch or fraction beyond the maximum slump specified and provided the required water-cement ratio is maintained.

10.4 Water-Cement Ratio

No deviations.

11. SLUMP MEASUREMENTS

11.1 Slump is to be determined in accordance with ASTM designation: C 143-39 or the latest revision thereof.

11.2 Slump is to be determined at 70° F. When measurements are made at any other temperature the Slump value used will be that measured after correcting as follows:

- A.. At higher temperatures, add to the measurement obtained at the rate of 3/8 inch for each 10° F above 70° F, but not more than 3/4 inch total correction.
- B. At lower temperatures, subtract from the measurement obtained at the rate of 1/2 inch for each 10° F below 70° F. See paragraph 19 regarding extreme temperatures.

12. APPLICATION OF DESIGNS

12.1 For structures with wall thickness of 5 inches or more:

MIX #4000
MIX #4001

12.2 For structures with wall thickness less than five inches:

MIX #4002
MIX #4003



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DETAILS OF CONSTRUCTION

13. FORMS AND SUPPORTS

- 13.1 Forms shall be smooth, well braced and must be tight enough to prevent any leakage of mortar. They shall hold the concrete in such manner that the finished structure conforms to the shape and dimensions specified. Tape or other impervious membrane covering shall be used as necessary to obtain tight form joints.
- 13.2 Earth surfaces, where used as forms, shall be covered with a tough impervious membrane such as sisal kraft or a similar material. No such covering is required under floors except where the earth is porous and very dry or where ground water is present.
- 13.3 Supports resting on the earth, and to become a part of the finished structure, shall be precast concrete equal to that in the structure.
- 13.4 Supports bearing on forms, and to become a part of the finished structure, shall be iron or steel in appropriate shapes.
- 13.5 Duct separators shall be precast concrete or a suitable inorganic material, either ceramic or plastic to serve the purpose.

14. PLACING REINFORCEMENT

- 14.1 Metal surfaces shall be clean and free of rust, scale or other coatings that might reduce bonding of the concrete.
- 14.2 Reinforcement shall be securely tied and in place before any concrete is poured in the structure except under the following conditions:
 - A. Where cold joints are specified or allowable.
 - B. Roof sections assembled and placed may be removed as an entire section, temporarily, if this is feasible.
- 14.3 Tolerances for steel clearance and spacing:
 - A. Clearances of three inches or less shall not be reduced but may be increased by one-half inch. Other clearances may vary one-half inch either way.
 - B. Location of reinforcing elements may vary up to two inches from that specified provided clearances are maintained and provided clear separation between adjacent parallel pieces, of less than two inches, is not reduced.
- 14.4 Steel spacers or similar supporting devices, shall be used as necessary to assure conformance of steel locations specified within the allowed tolerance.



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15. PREPARATION OF COLD JOINTS

- 15.1 The concrete surface to be joined shall be clean and free of loose material.
- 15.2 Sika seal or other specified material shall be applied to form a sealing membrane.

16. PLACING CONCRETE

- 16.1 Concrete shall be handled from mixer to place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients. It shall be placed in such manner as to avoid any appreciable flowing after the final depositing.
- 16.2 The placement shall be continuous and at such rate that cold joints do not develop excepting where cold joints are specified or optional.
- 16.3 Steel and forms shall be kept clean and free of concrete until covered with the pour.
- 16.4 Platforms, drop chutes, sheeting, and similar devices must be used as necessary to prevent segregation.
- 16.5 Concrete for vault and manhole walls shall first be deposited at roof level, then shoveled and dropped carefully straight down in such manner that segregation does not occur.

17. COMPACTION

- 17.1 Vibration compaction shall be used when required. Such compaction shall be done with an approved, internal type, mechanical vibrator having a speed not less than 4,500 RPM, operated and moved continuously by an experienced operator and augmented by rod tamping as necessary. Successive layers not more than 24 inches deep shall be placed and well compacted before placing each following layer. The vibrator shall be inserted at about 18 inch intervals, shall penetrate each layer completely and shall penetrate a preceding layer at least 12 inches.
- 17.2 Hand compaction shall be used when required. Such compaction shall be done with tamping rods being worked continuously through the wet mass as placed. Successive layers not more than 12 inches shall be placed and well compacted before placing each following layer. Tamping rods shall be used at the rate of one for each two yards per hour maximum rate of pouring. At least one man-hour of tamping shall be performed in each two yards of concrete poured in vaults and manholes. At least one man-hour of tamping shall be performed in each four yards poured for duct bank envelopes or pull boxes.
- 17.3 Compaction in the specified manner and at the required rate shall be performed in all concrete poured. This includes floors and roofs of structures as well as walls, pads, and duct bank envelopes.

18. SURFACE FINISHES

- 18.1 Rock pockets and other imperfections on exposed surfaces shall be patched and troweled to match the surrounding surface.
- 18.2 Floors shall be given a float or broom finish to provide a uniform but slightly rough surface.
- 18.3 When a finish course is poured on concrete which has set, it shall be at least two inches thick and in addition to the specified floor thickness.



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19. PROTECTION WHILE POURING AND CURING

- 19.1 Concrete shall be poured with the temperature of the mix between 40° F and 90° F.
- 19.2 When the ambient air temperature is below 40° F. the concrete shall be held to a temperature between 60° F and 90° F until set. Concrete will not be placed during freezing temperatures without special authorization.
- 19.3 Protection shall be provided as necessary to guard against freezing, premature drying, and any other conditions likely to be injurious to the concrete, until the specified strength is developed.
- 19.4 Curing shall be continued for at least seven days except that the time may be reduced as authorized by the Department when "high early strength" cement is specified.

20. REMOVAL OF FORMS

- 20.1 Supporting forms shall be left in place until the concrete has developed sufficient strength to be self-supporting without damage to itself.
- 20.2 The following are the minimum periods during which forms shall be left in place when Type II cement is used and curing conditions are favorable.
 - (1) 100 hours for roof supports.
 - (2) 100 hours for wall supports where the soil is not self-supporting.
 - (3) 75 hours for wall supports where the soil is self-supporting.
- 20.3 When "high early strength" cement is used the stripping time may be reduced as determined by the Department in each instance.

COMPLIANCE WITH SPECIFICATIONS

21. PURPOSE OF SPECIFICATION

The foregoing specifications are designed to produce a durable concrete with more than the specified minimum strength. The values and procedures specified are guides to be followed to obtain the required results and do not preclude in any manner such additional measures as may be necessary or advisable to secure such results.

22. REJECTED INSTALLATIONS

- 22.1 An installation may be rejected whenever 1) samples taken while pouring, or core samples taken within three months thereafter, fail to meet the required strength. 2) Whenever the specified thickness of concrete has not been placed. 3) Wherever it is found that full compaction has not been obtained.
- 22.2 Use of a water-cement ratio in excess of that specified will be sufficient cause for rejection.